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WIND EFFECTS

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THE following study is the outcome of attempts to improve the teaching of climates by basing climatic features more and more on weather or other concrete phenomena. We may regard climate as ideal and weather as concrete, just as spheres are ideal and balls are concrete. In teaching geometry, a good deal of difficulty arises from lack of specific effort on the teacher's part to help the beginner's mind to the ideal and abstract conceptions dealt with. And climate, as taught in many schools, amounts to little more than words to be memorized, because of utter lack of grounding in the real. The facts of the weather are real, concrete, and observable everywhere. If these facts are observed and studied, the features may be learned that characterize our climate. The drawing of inferences from the facts, however, involves mental processes in which the beginner needs training. The reasoning process should carry conviction. How often we hear a young thinker say, "Yes; I see that; but it does not seem as if it could be so." Familiarity with the inductive method is needed to give faith in it, and there is especial need of every possible test of the results. For this reason it is desirable to come to our conclusions by as many roads as we can find.

Supposing it is desired to get the student to believe in our westerly winds as an important climatic feature. We may work along three lines:

1. Observe the weather vane and after some months find which wind has blown oftenest.

2. Study the weather map and make out on it the procession of highs and lows to eastward.

3. Look at the trees that have grown exposed to the force of the winds for indication of thrust in one direction rather than in others.

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FIG. 1. *Yellow birch on west slope of Grant Hill, Gilmanton, N. H., looking north by east.*

FIG. 2. *Laurel near Cabañas fortress, Havana, looking west.*

Of the two pictures given, the first is a yellow birch in the Belknap Mountains in New Hampshire. The trunk is a little inclined to the west, owing to the common gravitative creep of the soil downhill, but the growth of the branches suggests a strong eastward movement of the air, although there was no wind at the time of the exposure. The whole tree makes one think of the hill as a wind-swept height. Such trees are not infrequently represented from mountains.* One thinks of westerly storms as driving these trees out of shape. So of

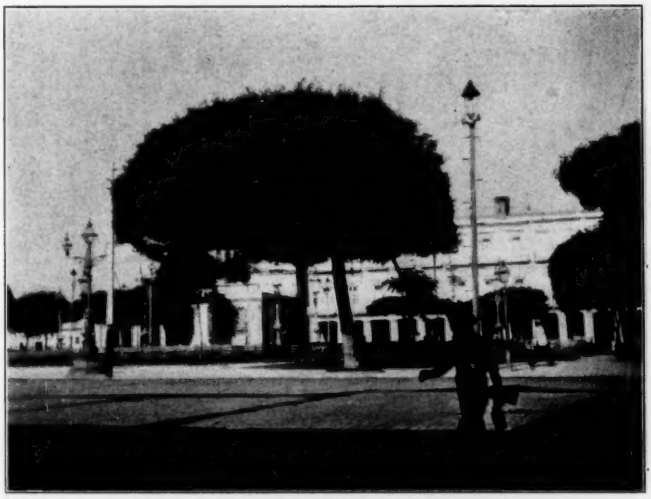

FIG. 3. *Laurel, Central Park, Havana, looking west.*

the windward side of the volcanic Caribbees, Hill says, "The trade wind sweeps them with such ferocity that the vegetation all bends in a cringing position towards the land."†

The laurel of the second view stands over the road from Cabañas fortress. There is no especial reason for speaking of violent winds here. The tree is near sea level, though exposed to the trade winds heightened in the daytime by the heating of the land. The "ferocity" of the trades, in Mr. Hill's language, is suggested rather by the striking effect than by the winds themselves. The trades are strong rather than violent. From this same point, by the entrance to Havana harbor, an avenue called the Prado leads off a little west of south, and down

* Chun, *Aus den Tiefen des Weltmeers*, p. 160. The pines near Cape Town.

† Hill, *Cuba, Porto Rico*, etc., p. 328.

this again are seen many notable examples of the one-sided growth of the vegetation. This is well shown in the laurels and framboyanes of the Central Park at the end of the Prado. Figure 3 is typical.

But continuity of direction in even moderate winds leaves record as definite and unmistakable as mountain storms. Our prevalent westerly winds are recorded in the growth of the maples from New England to Michigan. When the tree is in leaf the result is a one-sided growth, well displayed in Figure 4, while in the twig the effect is still clearer, as in the absolutely typical example from Ypsilanti, Figure 5.

About Ypsilanti the white poplar points its branches in unison down the wind, as does a fine example of the same tree in the Boston Public Garden. Figure 6 is a poplar at Ypsilanti.

FIG. 5. *Maple at Ypsilanti, looking north.*

The distinction between constant and prevalent winds enters largely into the difference between the climates of the trades and westerly wind belts, which between them occupy the greater portion of the earth. In the trades are clear skies, even temperatures, and winds always in the same quarter, rising and falling with some swing in

FIG. 6. *White poplar, Ypsilanti, looking north.*

direction at the shore; in the westerlies, spells of fine and spells of stormy weather, with winds veering and backing through all the points of the compass. To teach this properly, we must begin with the westerlies about us. But the westerlies are only an average, only an excess of one wind direction over others, and a difficulty for beginners lies at this point.

Suppose that we have gathered observations like those of the accompanying table, the percentages of the whole year that the wind is in each direction, at Detroit, for instance.

DURATION OF EACH WIND DIRECTION IN PERCENTAGES OF THE WHOLE YEAR

	Latitude	N	NE	E	SE	S	SW	W	NW	Calm
Boston	42°	8	9	10	4	7	20	23	19	0
Detroit	42°	5	15	9	7	5	31	13	15	0
San Francisco	38°	6	4	3	8	8	38	23	9	1
Dodge City	38°	13	15	5	24	18	6	4	15	0
Key West	25°	9	22	28	22	6	5	2	6	0
Santiago, Cuba	20°	18	28	4	10	17	10	2	4	7
Santo Domingo	18°	46	9	4	18	7	2	1	11	2
San Juan, P. R.	18°	1	8	39	36	6	5	1	2	3
Barbados	13°	1	30	48	19	1	1	0	0	0
Curaçao	12°	0	9	79	11	1	0	0	0	0

That is, for 59 per cent of the time the wind at Detroit is either in the NW, W, or SW. Yet a fact that always looks very large to a beginner is that the wind is NE as often as NW, and oftener than it is west. Moreover 59 per cent is only a little more than half the time. If he has access to the other numbers, he may find some reassurance in the data for Boston and San Francisco, but he will be certain to seize on Dodge City as giving the whole case away. Here is a place in the latitude of the westerlies with more east winds than west! All that this means is that concrete details have a reality that

FIG. 7. *Cocoanut palms at Santa Cruz, Danish West Indies, looking northwest.*

is not possessed in like degree by the conclusions drawn from them. If, however, we can now confirm these conclusions in any way, we shall strengthen the reasoning process. A map of the United States on which are laid down the average directions of all the winds at all places adds definiteness here. But as the effects of an excess of one wind direction are absolutely real and definite, the evidence of the trees that have been influenced by it in their growth is of the greatest value in teaching.

Spells of cyclonic and anti-cyclonic weather should be watched as they go by, with the help of the daily weather map, though they have not for the beginner so much reality.

That *temperate zone* is a misnomer for the belt of westerly winds has long been known. Probably there is nothing characterizes these regions so sharply as their winds, prevailing westerly, but interrupted by winds from all other compass points in succession. Nothing will

give a better notion of trade-wind weather than an absence of these fluctuations. Figures such as those for Curaçao and Barbados in the table may be contrasted with the figures for Boston or Detroit to get this idea. It is easier to grasp the average conditions in the trades since they occur daily. The other points for which wind directions are given in the table, however, have their average less distinct. Local influences such as the direction of the coast line are plainly influential here. What approach to these facts could be more real than such pictures as Figure 7?

Where sea and land breezes alternate, the excess in strength of the sea breeze comes out well in the growth of trees along shore. In some way, it is desirable to get the picture of these effects into the pupil's mind. A need for an explanation will then arise.

All this is antipodal to the method by which climates were taught first, and the weather never reached in teaching it all. As a result, the ideal thing, climate, existed in our minds as a lot of disconnected phrases that burdened the memory and left no more definite conceptions than that the Nile rose in summer or winter—one did not certainly remember which. The naming our zone *Temperate* seems only to rest on the climatic conception of our average temperature, some 60°, which sounds mild and temperate. Yet the actual weather could hardly be less temperate, ranging through temperatures from 100° to −40°. Nowadays we like to look for vigor and bracing for deeds in these immoderate ranges. It is in the belt of westerlies, with weather in spells, that civilization is taking the greatest strides in history, and there it seems likely to make others.

Civilization began in Babylonia and Egypt, in the belt that on sea is characterized by trade winds. It failed there, to try again in Mediterranean countries, on the border of the trade and westerly belts. There, too, a few centuries of progress ended in the shock with barbarism and collapse. With the revival of learning came men who accomplished things in the belt of westerlies, and there has been more of human progress in a few hundred years than in all the long past of the race.

Spain, the land that lay across the border of the belts, lingered in power into the dawning of the new epoch. The trade winds bore Columbus to America almost irresistibly, when once his mind was made up to go. Clear skies with fair and balmy winds accompanied him all across the Atlantic. There was no obstacle to his progress but the fear of the great unknown ocean that opened out wider and

wider before them day after day. Down the coast of Africa to the Canaries and Cape Verde, and thence straight across to the Antilles, the unfailing breezes wafted hordes of Spanish conquistadores to Mexico and Peru. The return was less easy, but any Spaniard who could buy a vessel and get together a crew became at once a sea captain and made his way to the new world of gold and opportunities.

A little farther north, where the English lived, other winds blew. The Englishman that crossed the Atlantic did so in the face of violent gales. Only seamen dared repeat the trip. Presently, when the Invincible Armada appeared in the English Channel, and the English came out in their trim seafaring ships, snug and stanch and well-handled, as the Spanish ships were not and could not be, the wind had only to rise to destroy Spain's pretense at naval power forever. The English had been to the best of schools of seamanship. The Spanish had lived by a tranquil sea, with all this schooling omitted. In Asia, India has given promise, but a better fulfillment seems reserved for Japan, and, perhaps, China, in the westerlies. In the new world, too, all the early hopes were founded on the trade-wind countries in the West Indies, Mexico, and Peru. To-day's fulfillment is all beyond in the westerly belt, here in our country, in Chile, and the Argentine Republic, as in South Africa, New Zealand, and southern Australia.

The typical wind effect is not an inclination of the trunk. The willow often has its trunk inclined to the east and its western branches fairly over the base of the tree. But this may be in some part due to the softness of the wet ground that this tree affects, which may yield somewhat to the force of the wind pulling on the roots. On the St. Clair Flats, Michigan, the delta of the St. Clair River, willows have been planted along the banks of the United States ship canal, and here and there about the buildings along the banks of natural channels. These willows, by their wind effect, enable the traveler to follow the windings of the canal as readily as a compass in hand. The electric road from Port Huron to Detroit, on the land just to the west of the St. Clair River and Lake, touches at the town of Algonac on the Flats and then, to continue to Detroit, has to make a long detour to west and north. During a first trip over the line, while the motor rendered the compass useless, the growth of the Lombardy poplars along the roadside seemed unintelligible. Upon examining a map, however, it became clear that they all showed an admirable wind effect to NE. The Lombardy poplar often grows erect in the wind.

In orchards, too, the trunks are usually inclined when the ground

beneath is cultivated, so that in the Michigan Fruit Belt it is the custom to set out the trees with a lean to the southwest, that they may be straightened by the wind. Here again it is possible that the cultivation softens the ground so as to allow the inclination in question.

FIG. 8. *Willow, Ypsilanti, looking south.*

No trees in groves show really typical wind effects, since the outer trees protect those within. In dense forest growth this causes light effects to acquire especial importance. The outer trees develop strongly in every direction away from the center, and those within reach up vertically for the light, pruning away the lower branches by failing to nourish them and their leaves. The best trees to examine are those that have grown in isolated fields, or in open order along roadsides. The typical effect is a bending or inclining of the twigs to leeward, and for this reason the best season for these studies is after the fall of the leaf. When trees are leaved out the main effect is a one-sidedness of the top. Not every tree standing alone has grown alone. Southern Ontario has many single trees, elms, and others,

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along the line of the Michigan Central Railroad, which seem exceptionally regular in growth. Their naturally pruned trunks and the abundant stumps about, however, indicate that these trees grew in a wood and were protected from the wind. Most trees that grow in the open branch from near the ground up, and by this they may be known.

The results of this modification of free growth are individual with each kind of tree. Cottonwoods in the country about Ypsilanti seem to grow uninfluenced by the wind, however exposed their situation. Figure 9 is a fair example. Yet all the cottonwoods in the Boston Public Garden, though less exposed to the wind than many of the trees at Ypsilanti, incline their branches off distinctly to the east. In the West Indies the royal palm stands vertical and columnar, though in this case, strangely enough, the newest leaf, rolled into a tight cane at the summit of the tree, leans slightly against the wind, as if some force that availed to keep the trunk upright against the wind-thrust, bent this tender shoot over backward. In the picture, Figure 10, the

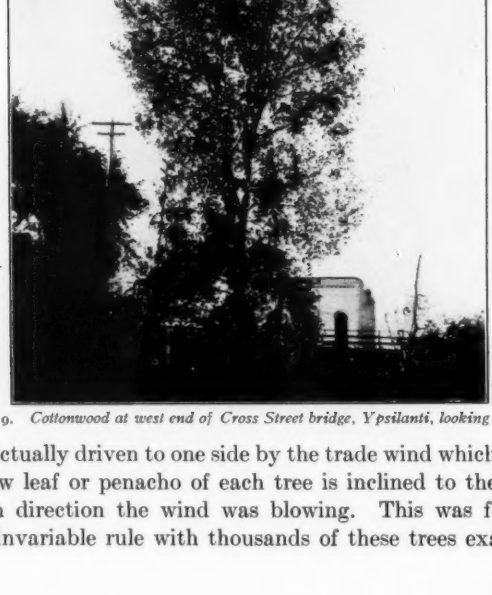

FIG. 9. *Cottonwood at west end of Cross Street bridge, Ypsilanti, looking north.*

leaves are actually driven to one side by the trade wind which is blowing, and the new leaf or penacho of each tree is inclined to the northeast, from which direction the wind was blowing. This was found to be an almost invariable rule with thousands of these trees examined this

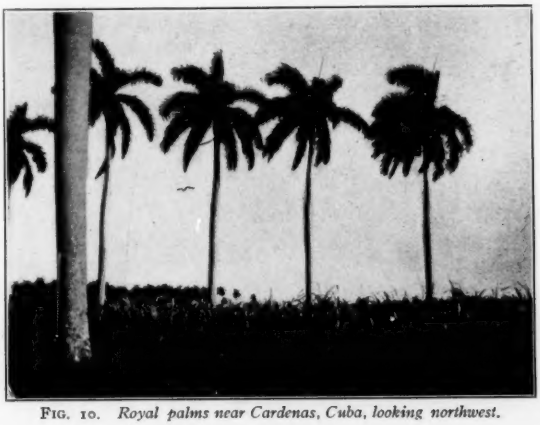

FIG. 10. *Royal palms near Cardenas, Cuba, looking northwest.*

summer in Cuba. While the cottonwood, at least about Ypsilanti, is thus resistant to wind effects, its cousin, the white poplar, shows them in a high degree. Indeed, while a careful observer has no difficulty in distinguishing the two trees, a novice would ask no better guide than the degree in which they yield to the influence of the wind.

In the poplar, curves are strongly developed. On the east side of the tree, the branches form curves concave to the ground. On the west, vertical lines would cut not a few branches in two points with the curve between concave to the east, so strongly are they bent to leeward as they grow. (See Figure 6.) In this case it is a branch effect rather than a twig effect, while the individuality of the poplar comes out in the curve. The Ypsilanti poplars show these forms, even when poorly exposed to the wind, and reference has already been made to the one in the Boston Public Garden.

The maple succeeds better in rearing its greater branches vertically into the air. There is a distinct curving here, too, in the more slender branches, but much less in degree. The maple runs to slender and hair-like twigs, and the development of the twigs is almost horizontal on the east side of the tree and vertical on the west, as if they had been combed upward on one side and outward on the other. (See Figure 5 and the tailpiece.) Maples give excellent wind effects everywhere that I have observed them. If there are any about Dodge City, Kansas, it would be of interest to know how they grow.

Elms, too, are available for observation through a wide stretch

FIG. 11. *Elm, southwest corner of Boston Common looking north across Boylston Street.*

of this country. The elm branches grow longer to eastward than to westward, which enables the slender ends to hang nearer the ground on the east. The trunk stands almost invariably to west of the mid tree-top. A fine example stands near the old burial ground on Boston Common. The twig effect on the elm is not unlike that of the maple, but the greater length of the pendulous end twigs takes away the appearance of combing upward on the west side. The tips of the lower limbs on both sides hang directly downward, but toward the

top of the tree the effects are almost identical with those observed on the maple. The crown of the elm, however, is flat. The Boston elm was photographed in September while still in leaf. Figure 12 is an example in twig. A photograph of the same tree from the west is quite symmetrical.

FIG. 12. *Elm at Ypsilanti, looking north.*

The oak and the hickory show the same excess in length of eastern over western branches, and the eastern ones also usually spring out more nearly horizontally. This appears very well in Figures 13 and 14, which are typical. Occasionally the oak shows a curving of its branches, but the type is stiff, crooking a little on either side of straight lines. The hickory branch is excessively crooked. Another crooked branched tree is the sycamore, or buttonwood, as shown in the tail-piece. But the crooks of the sycamore are rather in the smaller twigs, and the twigs are more of the combed type, as in the maple, having a considerable approach to parallelism, while the twigs of the hickory present a mere tangle. The wind effect on the hickory is thus a matter of one-sidedness, dependent on length of branch. In the sycamore it is equally evident in the direction of the twigs.

The black walnut also usually shows a greater development of top to leeward. A tulip tree east of the soldiers' monument in Boston

FIG. 13. *White oak at Ypsilanti, looking north.*

FIG. 14. *Hickory at Ypsilanti, looking north.*

Common shows distinct effect, apparently by curving its summit branches. But I have not observed this tree in the twig.

The cocoanut palms from Santa Cruz, Figure 7, show the wayward growth of that tree along with the influence on it of the northeast trades. I do not, of course, refer to the long fringes of these palms that are wont to line tropical shores at the top of firm beaches. There light effect causes them to reach away from the woods behind. But out in the open the tree seems to prefer to lean in its growth, quite apart from the direction of the wind. Some of the trunks have grown distinctly against it. So, with us, the box elder, for all its cousinship to

FIG. 15. *Alamos near Havana, Cuba, looking east-southeast.*

the maple, is rarely seen growing upright, wind or no wind. I know of no way of recognizing the tree so sure and simple as its habit of leaning, and neighboring specimens usually lean in different directions.

Many tropical trees resemble the maple in having their tops one-sided under wind influence, though they are one-sided to south or west instead of to east. The laurels of Figure 3 are of this type. So also the framboyan and the alamo, as in the accompanying sidewalk row, Figure 15. It must not be thought that these trees are leaning out over the street for light. There is an open yard to the northeast, and nothing to cut off light from that direction. On the opposite side of the street the trees lean in the same direction. Some of these may be seen in the picture. It is interesting to get generalized views of

FIG. 16. *Arbor vitaes at the Mausoleo, Cardenas, looking south.*

this sort by standing in the middle of a street that runs north and south and looking along the street. It will be found in this country that the meeting of the branches overhead is well to east of the middle of the road. The Charles Street mall of Boston Common offers a good illustration. The Ceiba or silk cotton tree is regarded by the Cubans as their national tree. It grows alone in the plains, with trunk rising naked a considerable height to the thick top which is always strongly developed to leeward.

Our pines and spruces commonly grow in woods or clusters and so are little affected by the winds. Even in the New Hampshire hills only exceptional examples were found. Creole pines may be seen planted in the gardens about Havana showing admirable effects. The arbor vitaes (thuyas) in the garden at Cardenas all lean to westward. But this garden is a new one, commemorating with its monument the dead of the recent war. So the trees have probably been planted within the last four or five years, and may have been simply pushed to one side before the roots got a firm hold on the ground. It is curious that the wind-thrust on these trees has been from the east, as in all cases near the shore at Cardenas, while the northeast side of each tree has a blighted look, as if the branches on that side had been killed by some storm from the northeast. Something of this blighted look may be seen in the picture.

In fact, both east and northeast winds prevail in northern Cuba. From an examination of the records of the United States Weather

Bureau at Havana for the years 1900, 1901, and 1902, it appears that the wind is in the east fifteen hours a day and in the northeast the rest of the time. This is true summer and winter. The seasonal differences are slight. But it appears that the greatest force is during the time that the northeast wind is blowing, so that five or six more miles of wind go by during the briefer period. It is from 11 A. M. to 7 P. M. that the Brisa blows, when the sun has heated up the ground. It is, therefore, to be regarded as a true sea breeze. Occasionally a land breeze springs up during the night. At other times it merely falls off in velocity and settles back into the east. The following table gives the data for every other hour:

AVERAGE WIND DIRECTION AND VELOCITY AT HAVANA, 1900, 1901, AND 1902

	A. M.						P. M.						
Time	1	3	5	7	9	11	1	3	5	7	9	11
Direction	E	E	E	E	E	NE	NE	NE	NE	NE	E	E
Miles per hour	7.7	7.3	7.2	7.4	10.1	13.2	15.1	16.6	15.5	12.6	10.3	8.9

FIG. 17. *White birch on the west slope of Baldface, Gilford, N. H., looking north-northwest.*

The east wind has an average velocity of 8.4 miles an hour; the northeast, 14.6. The vegetation suggests the northeast winds for most points between Havana and Cardenas, but shore places at Cardenas and Matanzas indicate easterly winds. Such studies may afford a

method of determining prevalent winds in regions meteorologically unexplored.

Light effects on tree growth are of much interest in connection with these wind studies. Trees tend to grow strongly toward the light. A singular example of an elm on the flood plain of the Huron, south of Ypsilanti, with a strong top growth to the northwest, was found to have alongside it the stump of a cut-away mate that had prevented it from developing to eastward. But more has been attributed to light effect than observation warrants. White poplars may be found close to the west of a house, but growing strongly toward it. Such observations as have been made seem to justify the statement that light usually has less effect on trees fairly exposed to the wind than the wind does. When they work in opposite directions the light effect is masked by that of the wind. It is not certain that the direct sunlight has more influence on tree growth than the diffused light of the sky. If it were, east and west rows of trees should have a greater development to the south. Is this observed?

An interesting persistence of wind effect is seen in Figure 17. Apparently hillside creep has caused the trunk to lean downhill, as the earth yielded beneath it. As there was free exposure to light and wind the twigs have continued to grow over to eastward. There is no sign of a stump or branch lost from the east side.

I believe school teachers who are willing to go out-of-doors will find value in observations like these.

A SCHEME OF GEOGRAPHY *

BY WILLIAM M. DAVIS,

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THERE is a certain profit in looking forward to the time when the Earth and its inhabitants shall have been so well studied that if all then known about them were put in print, the volumes thus formed would include the whole content of geography. The material there gathered might be arranged following either one of two

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plans. According to one plan, everything about a certain country would be brought together; this would make a treatise on regional geography. According to the other plan, all things of the same kind would be brought together; this would constitute a treatise on systematic geography. Under either plan, convenience would be served by adopting some reasonable scheme that might be invented for the arrangement of the parts into which the subject might be divided. Under regional geography, for example, the arrangement might be according to the continents and their political subdivisions. Under systematic geography, the arrangement might follow the usual order of globe, atmosphere, oceans, lands, inhabitants. Under each plan, use would be made of the other as a secondary guide. All the items under Mexico in a regional treatise should follow a systematic order of presentation; while all examples of a certain kind of lakes in a systematic treatise should follow a regional order of presentation.

A complete geographical treatise, regional or systematic, would be inconveniently bulky. Abbreviated editions would be in demand, and they might be abbreviated in several ways. In one way, unimportant or inconspicuous items would be omitted, and important or conspicuous items retained, wherever or whatever they might be. In another way, remote items might be omitted and home items retained. In a third way, difficult items would be omitted and elementary items retained. Thus hand books and school books would be developed.

There can be little doubt that the abbreviated or simplified editions would gain in value with the approach to completeness of the treatises on which they were based, as well as with the competence of their authors. A hundred years ago the best geographies were necessarily silent concerning the then extensive unexplored parts of the world. To-day the best geographies contain a much larger body of information than their predecessors, but they are still silent concerning many of the more advanced problems of geography. A hundred years hence there may be still much to learn, but great progress will by that time have been made in the more philosophical phases of geography, to which attention is not yet sufficiently directed. It is with the object of calling attention to some of these phases that this note is written.

The direction in which geographical progress is to be made in the next hundred years may perhaps be forecast from the direction of progress in the last hundred. Geography used to be a "study of the Earth and its inhabitants." Items were brought together in great number; they were described more or less empirically; but there was

no sufficient effort made to explain and to correlate them. Correlation was greatly promoted by Ritter and his followers. Geography then became, not simply a study of independent items, but a study of the Earth and its inhabitants in their mutual relations. With the advance of science in general, the description of geographical items became more and more explanatory; but progress in the larger problems of correlation was retarded for half a century by the prevalence of a teleological philosophy, and until this was replaced by the doctrine of evolution, the modern phase of geography could not be reached.

In its present modern phase, geography is essentially concerned with the rational correlation of the items that fall under its two parts: on the one hand, the items of inorganic conditions that constitute the physical environment of living forms; and on the other hand, the items of organic response made by living forms to their environment. The first of these two parts is commonly called physical geography. In the United States this term is coming to be condensed into physiography.* The second part has no name; it includes certain phases of political and commercial geography, and it goes much further than either, because it is concerned with all forms of life instead of only with man and what is useful to him. It will here be called ontography; the main root of the word corresponding to that of paleontology, and the termination agreeing with that of physiography and of geography.

Thus understood, geography is concerned with the combination of physiography and ontography; that is, with the correlation between inorganic environment and organic response. Individual items, such as the course of an ocean current, the path of a valley, the area of a forest, the population of a village, fall under the physiographic or the ontographic division of the subject, and must there be studied as carefully and rationally as possible; but they will fail to attain a truly geographic quality as long as they are treated independently, instead of being brought into proper correlation with their fellows. The physiographic items, regarded as elements of controlling environment, must be associated in thorough-going geographical work with the ontographic responses that they have evoked. The ontographic items, regarded as responses to environing conditions, must be associated with the physiographic controls by which they have been governed. The course of a current will affect the distribution of living forms or

* Thus employed, physiography is not directly concerned with astronomy and geology, or with physics and chemistry, as it has come to be, unfortunately, in my opinion, in England.

the lines of navigation; the path of a valley will determine the location of roads and villages; the area of a forest is the response to land form, climate, and soil; the population of a village depends on many environing factors.

No full measure of geographical treatment will be reached by the student who restricts his work either to the inorganic or to the organic half of the subject. Those who wish to train themselves to be fully equipped geographers should gain not only the capacity, but also the

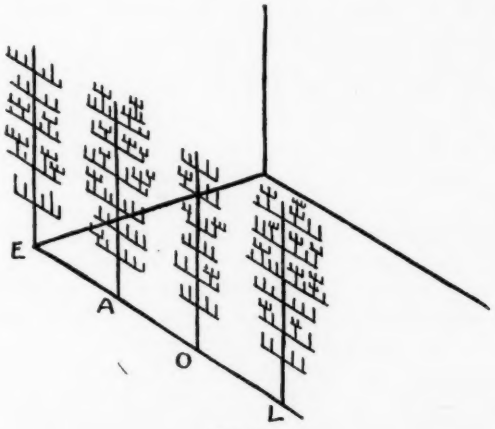

FIG. 1.

habit of giving due attention to ontography and physiography combined. The best geographical works to-day clearly enough exhibit the beginning of this double consideration of their subject, but they usually fall short of carrying the treatment thoroughly and uniformly over all aspects of the subject, and they commonly fail to show that their plan of treatment has been adopted in accordance with a sufficiently comprehensive view of geography as a whole. It is still usual in the best modern books to find many facts described as if they were lonesome, individual occurrences, instead of members of a recognized class, and to find their description closed before they have been systematically correlated with their responses or their controls.

The quality of geography, as a whole, may be presented and emphasized by a simple graphic device that experience has shown to have some value. Imagine the four frameworks, *E*, *A*, *O*, *L*, Figure 1, to

stand in a vertical plane over the line *EL*, and to contain compartments for all the topics of systematic physiography under the larger headings of the Earth as a globe, the atmosphere, the oceans, and the lands. The compartments may be taken to represent types, with respect to which actual examples are classified. It may be briefly pointed out, although it is not intended to delay here in explaining all the practical value of this part of the device, that the observer is greatly aided in his work if he carries mentally into his field of study a well-arranged framework on which the types that embody the results of all previous investigations are carefully defined and arranged; for there can be no question that the habitual treatment of every observed physiographic item as far as possible as a member of a known class, is a most practical and serviceable aid in field observation and record. The framework must not be imagined to represent a rigid and unchangeable scheme; it should be elastic and adjustable, constantly modified in response to accepted suggestions for improvement as investigation progresses.

Physiography is, to-day, relatively well developed; and the classification of its parts representable in a framework is fairly well advanced, although, for that matter, there is yet by no means so general an agreement among physiographers, with respect to the systematic subdivision and arrangement of the items with which they have to deal, as there is among botanists and zoölogists with respect to the systematic classification of plants and animals. Some physiographers, for example, treat rivers and oceans in one division apart from the lands; others treat oceans and coasts together, before the lands have been studied; but both these plans are fortunately unusual. Ontography, on the other hand, has hardly any recognized scheme of treatment; it has still to be systematically studied. The framework on the farther side of Figure 2, by which a classification of organic responses is here roughly indicated, must therefore be taken for the present as suggesting what may yet be done rather than as representing what has already been done in this direction.

Even the limits of ontography are not yet agreed upon, and in considering with historians, zoölogists, and botanists how far this division of geography may be reasonably extended, it is sometimes the case that one encounters certain indications of jealousy and accusations of trespass. Here, however, as in other sciences, it is not so much the object studied as the relation in which it is studied that determines its place in a scientific classification. The same object may be studied in its varied relations under several different sciences.

Surely history, zoölogy, and botany make use of geographical items so often that there can be little ground of just complaint if geography finds occasion to examine facts that are commonly associated with these other divisions of knowledge.

The most reasonable method of determining the limits of ontography seems to be the following: Select certain examples of undoubtedly ontographic facts, and then, under the principle of continuity, follow the lead of the classes to which these facts belong as far as they can be traced; otherwise the limits must be arbitrary or conventional. Thus there will be found certain facts that are indisputably and centrally ontographic, while others are peripheral, and are more or less shared with other sciences; but in the latter case all the sciences concerned are equally trespassers. These abstract considerations may be illustrated to advantage by some concrete examples.

The location of a village at the head of a bay on the sea-coast must be considered by every one to be a geographic item, and, according to the plan here presented, it will fall under the ontographic half of the subject. In old-fashioned geography, such an item would have been empirically stated, without explanation of its meaning; in more modern geography, it would be rationally described as an example of a class of responses in which man's way of doing things is determined by his physiographic surroundings. Need having arisen of interchange between land and sea (this itself being an important ontographic matter), the coast line gains importance because it separates two kinds of activities; and protected points on the shore line, such as bay heads. become of exceptional importance, because here the interchange between the two kinds of activities can be effected with the least difficulty. Now, the essential quality of this item is that certain organic inhabitants of the Earth have found it to their advantage to be guided in certain actions by the conditions of their inorganic environment. Hence, under the principle of continuity, every other item in which an organism is thus guided to act in certain ways is also of an essentially ontographic quality. It matters not whether the organism is man, animal, or plant, whether the action is conscious or unconscious, whether it is of great or little importance; the essential feature is that the item must involve a response or reaction of organism to environment. It is only by adopting an arbitrary limit for ontography, and hence also for geography, that anything narrower than this broad definition can be regarded as indicating its field.

The whole content of ontography, thus broadly defined, is not

known, because its field has not yet been carefully examined; but enough is already known to show that the subject is of great and varied interest. It may be reviewed in two ways: All kinds of items found in the physiographic framework may be examined as to their responses in the organic world; or all kinds of organisms may be examined to see how far their structures, actions, and distribution are responses to physiographic controls. For example, in response to the important physiographic control of gravity, one finds the development of dorsal and ventral structures in many animals; those which escape this control are the minute organisms that are wafted about in the atmosphere, and the jelly-like organisms that float indifferently in one attitude or another in water. Again, one finds many details of bony structure and muscular arrangement adapted to support the body against the pull of its weight. The habit of building walls vertical, and of grading railroads nearly horizontal come under the same control. Even language is affected indirectly, as in such adjectives as grave and upright, in their figurative meanings. On the other hand, one finds in the growth of trees the responses to many controls—to gravity and the search for ground water in the growth of the roots; to gravity and the search for light and air in the growth of the stem; to form of land surface and depth and character of soil, as well as to various elements of climate in the determination of distribution.

It is evident that in most cases the responses above mentioned are not the result of the immediate adjustment of organism to environment, but of a gradual adjustment through long periods of past time, perpetuated through inheritance, provided the controlling conditions and need of adjustment still persist. The use of oxygen in respiration, universal in all plants and animals, is a case in point. This habit must be taken as indicating the presence of free oxygen in the ocean (dissolved) or in the atmosphere since the earliest geological periods from which fossils are preserved; the habit persists because the need and the opportunity still endure. The fur of many land mammals is a response to climatic controls; but in the marine mammals, that are in all probability descended from fur-bearing ancestors, the fur is replaced by blubber. Examples of more immediate adjustment are chiefly found in actions, as when horses and cattle on the western semi-arid plains of the United States wear paths from pasturing uplands to watering-places in the valleys, and yet here, as before, habit formed through long inheritance is the mainspring of action.

The classification employed in the ontographic framework may,

in view of what has now been said, be imagined to follow either one of two plans. In one plan, all the responses to one kind of control are gathered in a single compartment, and there would be as many ontographic as physiographic compartments; this plan is followed in Figure 2. In the other plan, each compartment would correspond to a kind of organism, and there would be as many compartments as might be needed to contain the subdivisions of the vegetable and animal kingdoms. Whichever plan is adopted, there can be little doubt that when

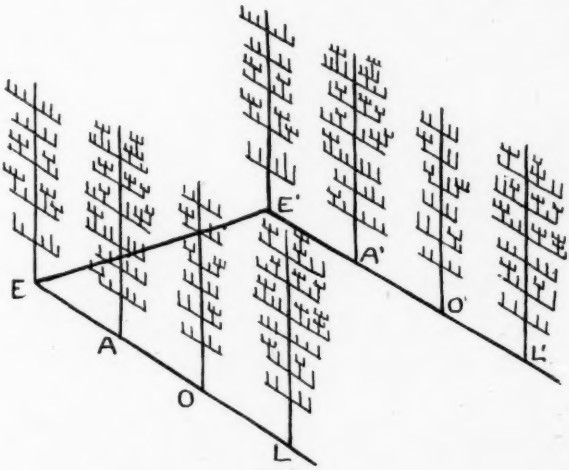

FIG. 2.

ontography is as well developed as physiography, geography will be greatly advanced. That stage of the development of our subject may be represented in Figure 3, in which the correlation of physiographic and ontographic items is indicated by lines that stretch across from one framework to the other, the first of the above-mentioned two plans for ontographic classification being here again illustrated. The conscious recognition and discussion of the correlations thus indicated graphically by the cross-lines is indispensable for the full development of modern geography.

It should be noted in passing, but for the present only in the briefest manner, that there are innumerable correlations to be found also among the items of each framework, considered alone. For example, London markets are to-day supplied with meat products from

Argentina and Australia, where herds of cattle and flocks of sheep find cheap pasture on broad plains fit for few other uses than grazing: these are correlations among items on the ontographic framework. On the other hand, the cliffs of Cornwall result from the interaction of waves driven by winds excited by sunshine and of currents involved in tides excited by lunar attraction, on the rocky structures exposed

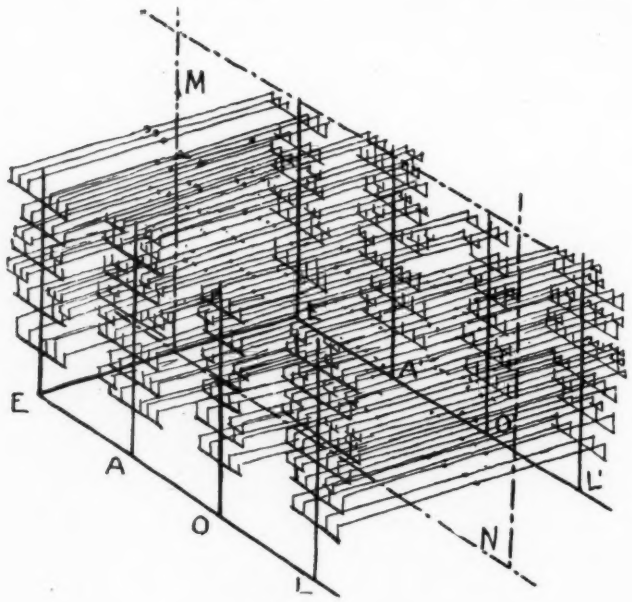

FIG. 3.

along the present coast line by crustal movements. Again, in a maturely dissected region, such as the Piedmont belt of North Carolina, one may recognize the wonderfully delicate interdependence of hillside slopes, soil creep, stream wash, and river work that is involved in the thoroughly organized condition of the drainage systems there established. Both these examples exhibit correlations of items on the physiographic framework. None of these correlations are, however, shown in the diagrams, for fear of too great a confusion of lines. With this digression, we may return to the consideration of Figure 3.

Imagine now a vertical plane, *MN*, parallel to the planes of the two

frameworks and midway between them. This new plane will be intersected by all the cross-lines of correlation, and the summary of all the points of intersection may be taken to exhibit the whole content of systematic geography. The plane may be shifted towards one of the other frameworks, if it is desired to give greater emphasis to one or to the other part of geography, but the well-balanced geographer will doubtless prefer to hold a plane midway in a position as here indicated. In case the biological classification of ontographic items were adopted, the lines of correlation would not be parallel; a group of lines would radiate from each kind of physiographic control in the framework to all of its ontographic responses, and various lines from numerous kinds of controls would be focused on the kind of organism in the further framework that responded to them.

It was stated above that this graphic device has been found by experience to have some value in indicating the compound nature of geography, as it is here defined, and in illustrating the relation of its parts. It has a further value, namely, an aid in the practical analysis of a geographer's work. If, in the course of exploration or other study, an item of physiographic nature is found, the geographer must at once seek to place it in its proper relation to all other physiographic items, and to discover all the ontographic responses that it has excited. If an ontographic item is discovered, its physiographic controls must be sought for. The correlations between the two must be studied out.

This may seem so simple, so manifest, that it is hardly worth the saying; yet if any standard work on geography is examined and analyzed, it will be found far from complete in the sense of completeness here indicated. The work undoubtedly will give, more or less explicitly, many examples of correlation between controlling environment and responding organism, and it will thus confirm more or less clearly the compound nature of geography here exposed; but it will be only by way of rare exception that both phases of the subject are systematically presented, and that the correlations between them are consciously and completely analyzed. Exploration, in so far as matters of occurrence and location are concerned, has now been well advanced; exploration, in so far as thorough analysis of cause and effect, is concerned, still affords plentiful opportunity for the investigator. There can be little question that studious observation and thorough record will be greatly aided when some such method of analysis as is here indicated shall have become familiar and habitual.

A few illustrations may be given to exhibit the breadth of geography,

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when it is expanded by the due consideration of its many parts. One is taken from an account of the oasis of Suf, in the Algerian Sahara, by Brunhes of Freiburg. This observer points out a relation between the sandy surface of the oasis and the character of the people, as follows: Every walking animal leaves its track in the sand, and from this follows an extraordinary skill on the part of the natives in tracking men and beasts; individual footprints can be recognized and followed through a confusion of crossing trails, where the untrained eye of a European would be unable to distinguish one track from another. As a result, theft is said to be less common in the sandy Suf than in the stony oases; the thief is so surely tracked and found that thieving is unprofitable.

Another example is furnished by Lugéon of Lausanne, who describes the relation between villages and alluvial fans in the higher valleys of the Alps. The fans offer the best sites for occupation; nearly every fan has its own village, each with its own organization, and the distribution of villages depends closely upon the distribution of fans. As most of the fans are of small area, most of the villages must be of small size. An earlier writer has instanced the development of these small village communities as illustrating the innate spirit of independence in the Swiss people; But Lugéon points out that small communities necessarily result from the small fans, and then aptly inquires whether the spirit of independence is not more probably a consequence than a cause of the subdivision of village communities.

Instances of this sort might be given in great number. Baku, the petroleum port on the arid shores of the Caspian, has rapidly grown to a population of something like one hundred fifty thousand souls in consequence of the discovery and exploitation of rock oil near by. So large a population needs an abundant water-supply, not easily to be had in a region of so dry a climate as that of western Asia. Water could be brought at a considerable expense from a river over fifty miles away, but capitalists hesitate to undertake the construction of so long an aqueduct for a city whose population will mostly move away when the oil-wells give out; hence, at present, the local supply from wells of unsatisfactory quality is supplemented by distillation from the brackish Caspian, oil fuel being very cheap, and an ingenious system of boiling and condensation producing four pounds of distilled water for one pound of fuel. Nowhere else in the world is a distillery run on so large a scale and with so temperate an object! And who shall say that Baku's rapid growth and uncertain life, as well as its peculiar water-supply, are not ontographic items?

It is not intended to assert that all the examples of cause and consequence that might be given are established beyond dispute, but rather that they show the importance of making a thorough collection, a careful analysis, and a systematic classification of all such examples in order to carry forward the development of geography and to discover its entire content. Evidently errors may be made in speculations of this kind; for example, it does not seem safe to follow the statement of a famous geographer to the effect that the (supposed) taciturnity of the American Indian resulted from the darkness of the forest in which he lived. It is on the careful analysis of abundant observations, rather than on the refusal to speculate as to cause and consequence, that geography will thrive.

It is desirable that geography should be presented, even to beginners, as a subject involving the correlation of physiographic and ontographic items. When the globular form of the Earth is taught, that is the time to point out how largely the modern development of commerce results from the nearly level form that a globe alone possesses. When the size of the Earth is taught, that is the time for telling about the effects of its size in isolating savage races, and thus producing differences of language and customs, as well as for showing how greatly modern means of transportation and communication have overcome the earlier effects of isolation. With the form and rotation of the Earth there should be immediately associated the modern habit of laying out the boundaries of unsurveyed territories, as in North America, Australia, and Africa, along the meridians and parallels; and so on through the whole subject. Thus the young student may be thoroughly infected with the idea of correlation, and from such an introduction to geography he may more probably contribute afterwards to its advancement than if he has been taught in the old-fashioned empirical way, or in the more modern method of imperfectly developed correlation.

The most important steps towards the fuller development of geography, therefore, seem to be: First, the formation of the habit of looking for correlations of physiographic and ontographic items; and, second, the development of a well-considered classification of all items, physiographic and ontographic, so that all may be considered in reference to their fellows.

GEOGRAPHICAL NOTES

Some Facts About Panama.—The commerce of Panama amounts to about three million dollars per annum; its population to about three hundred thousand, and its area to 31,571 square miles, or nearly equal to that of the State of Indiana. These figures are the latest available data on commerce, population, and area. Those of commerce are from the reports of the United States consuls at Panama and Colon, which have just been received, and not yet published; those of population are based upon the latest official estimate, which shows the population in 1881, and was based upon the census of 1871; while the figures of area are from accepted geographical authorities and are those of the area of the "Department of Panama" of the Colombian Republic. The principal ports are Panama, on the Pacific coast, and Colon, on the Atlantic side, and these ports are visited annually by more than one thousand vessels, which land over one million tons of merchandise and nearly one hundred thousand passengers, chiefly for transfer over the Panama Railway, forty-seven miles in length, connecting the Pacific port of Panama with the Atlantic port of Colon.

Colon, or Aspinwall, as it is sometimes called, has a population of about three thousand persons. The city of Panama has a population of about twenty-five thousand. It was founded in 1519, burned in 1671, and rebuilt in 1673, while Colon is of much more recent date, having been founded in 1855.

The population, which, as already indicated, amounts in number to about three hundred thousand, is composed of various elements—Spanish, Indian, Negro, and a limited number of persons from the European countries and the United States, especially those engaged in commerce and transportation, and the operation of the Panama railway. A considerable number of the population is composed of persons brought to the isthmus as laborers for the construction of the canal, and of their descendants. Since the abolition of slavery in Jamaica, a considerable number of blacks and mulattoes have settled on the isthmus as small dealers and farmers, and in some villages on the Atlantic side they are said to be in the majority, and, as a result, the English language is much in use, especially on the Atlantic side. Some of the native population have retained their customs, speech, and physical type, especially those in the western part of the province, and

claim to be descendants of the natives found in that section by the Spaniards when they discovered and conquered the country.

Of the commerce of Panama, the United States supplies a larger share than any other country. The importations at the port of Colon during the fiscal year ended June 30, 1903, as shown by the report of the United States consul, amounted to $952,684, of which $614,179 was from the United States, $119,086 from France, $118,322 from England, $76,386 from Germany. The figures of the fiscal year 1903 show a considerable increase from those of 1902, in which the value of the imports at Colon were $776,345. Of the $614,179 imports from the United States at Colon in 1903, $200,744 was dry goods, $189,333 provisions, $59,890 coal, $38,642 lumber, $32,900 kerosene, $30,400 liquors, and $31,940 hardware. The value of the importations from the United States in 1903 exceeded those of 1902 by about one hundred sixty thousand dollars. The exports to the United States from Colon in 1903 amounted to $173,370, of which $75,432 was bananas, $54.960 cocoanuts, $12,472 turtle shells, $9,400 ivory nuts, $6,460 hides, and $5,924 coffee.

From the port of Panama the exports to the United States in the fiscal year 1903 amounted to $193,342, of which $56,767 was hides, $49,974 india rubber, $27,805 cocobolo nuts, $16,598 ivory nuts, $13,372 deerskins, and $6,908 coffee. The consul at Panama states that the imported articles come mostly from England, Germany, France, Italy, and the United States, but gives no statistics of the imports.

Panama is connected with San Francisco by a weekly steamer schedule operated by the Pacific Mail Steamship Company, and with Valparaiso by a weekly steamer schedule operated by the Pacific Steam Navigation Company and South American Steamship Company. Two passenger and two freight trains leave Panama daily for Colon, and Colon daily for Panama. The time for passenger trains over the forty-seven miles of railway is three hours.

From Panama there is one cable line north to American ports, and one to the south. The actual time consumed in communicating with the United States, and receiving an answer, is stated by the consul to be usually about four hours. There are also cable lines from Colon to the United States and Europe.

The money of the country is silver, the rate of exchange having averaged during the past year about 150 per cent.—*Bureau of Statistics, Department of Commerce and Labor.*

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The Ship Canals of the World.—The ship canals of the world are nine in number, as follows:

(1) The Suez Canal, begun in 1859 and completed in 1869.

(2) The Kronstadt and St. Petersburg Canal, begun in 1877 and completed in 1890.

(3) The Corinth Canal, begun in 1884 and completed in 1893.

(4) The Manchester Ship Canal, completed in 1894.

(5) The Kaiser Wilhelm Canal, connecting the Baltic and North Seas, completed in 1895.

(6) The Elbe and Trave Canal, connecting the North Sea and Baltic, opened in 1900.

(7) The Welland Canal, connecting Lake Erie with Lake Ontario.

(8 and 9) The two canals, United States and Canadian, respectively, connecting Lake Superior with Lake Huron.

THE SUEZ CANAL

The Suez Canal is usually considered the most important example of ship canals, though the number of vessels passing through it annually does not equal that passing through the canals connecting Lake Superior with the chain of great lakes at the south. In length, however, it exceeds any of the other great ship canals, its total length being ninety miles, of which about two-thirds is through shallow lakes. The material excavated was usually sand, though in some cases strata of solid rock, from two to three feet in thickness, were encountered. The total excavation was about 80,000,000 cubic yards under the original plan, which gave a depth of twenty-five feet. In 1895, the canal was so enlarged as to give a depth of thirty-one feet, a width at the bottom of 108 feet, and at the surface of 420 feet. The original cost was $95,000,000, and for the canal in its present form slightly in excess of $100,000,000. The number of vessels passing through the canal in 1870 was 486, with a gross tonnage of 654,915 tons; in 1875, 1,494 vessels, gross tonnage, 2,940,708 tons; in 1880, 2,026 vessels, gross tonnage, 4,344,519 tons; in 1890, 3,389 vessels, gross tonnage, 9,749,129 tons; in 1895, 3,434 vessels, gross tonnage, 11,833,637 tons; and in 1900, 3,441 vessels, with a gross tonnage of 13,699,237 tons. The revenue of the canal is apparently large in proportion to its cost, the *Statesman's Yearbook* for 1901 giving the net profits of 1899 at 54,153,660 francs, and the total amount distributed among the shareholders 51,538,028 francs, or about 10 per cent of the estimated cost of $100,000,000.

The canal is without locks, being at the sea level the entire distance. The length of time occupied in passing through the canal averages about eighteen hours. By the use of electric lights throughout the entire length of the canal, passages are made at night with nearly equal facility to that of the day. The tolls charged are 9 francs per ton net register, "Danube measurement," which amounts to slightly more than $2 per ton United States net measurement. Steam vessels passing through the canal are propelled by their own power.

THE KRONSTADT AND ST. PETERSBURG CANAL

The canal connecting the Bay of Kronstadt with St. Petersburg is described as a work of great strategic and commercial importance to Russia. The canal and sailing course in the Bay of Kronstadt are about sixteen miles long, the canal proper being about six miles and the bay channel about ten miles, and they together extend from Kronstadt, on the Gulf of Finland, to St. Petersburg. The canal was opened in 1890 with a navigable depth of 20½ feet, the original depth having been about nine feet; the width ranges from 220 to 350 feet. The total cost is estimated at about $10,000,000.

THE CORINTH CANAL

The next of the great ship canals connecting bodies of salt water, in the order of date of construction, is the Corinth Canal, which connects the Gulf of Corinth with the Gulf of Ægina. The canal reduces the distance from Adriatic ports about 175 miles and from Mediterranean ports about 100 miles. Its length is about four miles, a part of which was cut through granitic soft rock and the remainder through soil. There are no locks, as is also the case in both the Suez and Kronstadt Canals already described. The width of the canal is seventy-two feet at bottom and the depth 26¼ feet. The work was begun in 1884 and completed in 1893 at a cost of about $5,000,000. The average tolls are 18 cents per ton and 20 cents per passenger.

THE MANCHESTER SHIP CANAL

The Manchester Ship Canal, which connects Manchester, England, with the Mersey River, Liverpool, and the Atlantic Ocean, was opened for traffic January 1, 1894. The length of the canal is 35½ miles, the total rise from the water level to Manchester being sixty feet, which is divided between four sets of locks, giving an average to each of fifteen feet. The minimum width is 120 feet at the bottom and averages 175 feet at the water level, though in places the width is extended to 230 feet.

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The minimum depth is twenty-six feet, and the time required for navigating the canal, from five to eight hours. The total amount of excavation in the canal and docks was about 45,000,000 cubic yards, of which about one-fourth was sandstone rock. The lock gates are operated by hydraulic power; railways and bridges crossing the route of the canal have been raised to give a height of seventy-five feet to vessels traversing the canal, and an ordinary canal, whose route it crosses, is carried across by a springing aqueduct composed of an iron caisson resting upon a pivot pier. The total cost of the canal is given at $75,000,000. The revenue in 1901, according to the *Statesman's Yearbook*, was £621,128, and the working expenses, £483,267. For the half year ending June 30, 1900, the canal yielded £16,488 toward paying the £112,500 of interest which the city of Manchester has to pay on the capital invested in the enterprise. The freight-paying tolls on the canal amounted to 1,487,841 tons in the half year, an increase of 12 per cent over that of the corresponding period of the preceding year.

THE KAISER WILHELM CANAL

Two canals connect the Baltic and North Seas through Germany, the first, known as the Kaiser Wilhelm Canal, having been completed in 1895 and constructed largely for military and naval purposes, but proving also of great value to general mercantile traffic. Work upon the Kaiser Wilhelm Canal was begun in 1887, and completed, as above indicated, in 1895. The length of the canal is sixty-one miles, the terminus in the Baltic Sea being at the harbor of Kiel. The depth is 29½ feet, the width at the bottom seventy-two feet, and the minimum width at the surface 190 feet. The route lies chiefly through marshes and shallow lakes, and along river valleys. The total excavation amounted to about 100,000,000 cubic yards, and the cost to about $40,000,000. The number of vessels passing through the canal in 1900 was 21,571, with a tonnage of 4,282,258, and the dues collected amounted to 2,133,155 marks.

SHIP CANALS CONNECTING THE GREAT LAKES OF NORTH AMERICA

Three ship canals intended to give continuous passage to vessels from the head of Lake Superior to Lake Ontario and the St. Lawrence River are the Welland Canal, originally constructed in 1833 and enlarged in 1871 and 1900; the St. Marys Falls Canal at Sault Ste. Marie, Mich., opened in 1855 and enlarged in 1881 and 1896, and the Canadian Canal at St. Marys River, opened in 1895. In point of

importance, measured at least by their present use, the canals at the St. Marys River by far surpass that of the Welland Canal, the number of vessels passing through the canals at the St. Marys River being eight times as great as the number passing through the Welland, and the tonnage of the former nearly forty times as great as that of the latter. One of the important products of the Lake Superior region, iron ore, is chiefly used in the section contiguous to Lake Erie, and a large proportion of the grain coming from Lake Superior passes from Buffalo to the Atlantic coast by way of the Erie Canal and railroads centering at Buffalo. The most important article in the westward shipments through the Sault Ste. Marie canals, coal, originates in the territory contiguous to Lake Erie. These conditions largely account for the fact that the number and tonnage of vessels passing the St. Marys River canals so greatly exceed those of the Welland Canal.

The Welland Canal.—The Welland Canal connects Lake Ontario and Lake Erie on the Canadian side of the river. It was constructed in 1833 and enlarged in 1871 and again in 1900. The length of the canal is twenty-seven miles, the number of locks twenty-five, the total rise of lockage 327 feet, and the total cost about $25,000,000. The annual collection of tolls on freight, passengers, and vessels averages about $225,000 and the canal is open on an average about two hundred and forty days in a year.

The Sault Ste. Marie Canals.—The canals of Sault Ste. Marie, Mich., and Ontario, are located adjacent to the falls of the St. Marys River, which connects Lake Superior with Lake Huron, and lower or raise vessels from one level to the other, a height of seventeen to twenty feet. The canal belonging to the United States was begun in 1853 by the State of Michigan, and opened in 1855, the length of the canal being 5,674 feet, and provided with two tandem locks, each being 350 feet in length and seventy feet wide, and allowing passage of vessels drawing twelve feet, the original cost being $1,000,000. The United States Government, by consent of the State, began in 1870 to enlarge the canal, and by 1881 had increased its length to 1.6 miles, its width to an average of 160 feet, and its depth to sixteen feet; also had built a single lock 515 feet long and eighty feet wide, with a depth of seventeen feet on the sills, which was located 100 feet south of the State locks. The State relinquished all control of the canal in March, 1882. In 1887 the State locks were torn down and replaced by a single lock 800 feet long, 100 feet wide, and a depth of twenty-two feet of water on the sills. This lock was put in commission in 1896. The canal was also

deepened to twenty-five feet. The Canadian canal, 1¼ miles long, 150 feet wide, and twenty-two feet deep, with lock 900 feet long, sixty feet wide, with twenty-two feet on the miter sills, was built on the north side of the river during the years 1888 to 1895. The number of vessels passing through the United States canal in 1902 was 17,588, and through the Canadian canal 4,204. In 1900 the number of vessels passing through the United States canal was 16,144, and through the Canadian canal 3,003, showing an increase of 1,200 in the number of vessels passing through the Canadian canal, and a slight decrease in the number through the United States canal, the increase in the number passing through the Canadian canal having been due to the development of the Michipocoten district. The tonnage passing through the United States canal in 1902 was: Registered tonnage, 27,408,021 tons; in 1901, 22,222,334 tons, against 20,136,782 in the year 1900; the freight tonnage in 1901 was 25,026,522 tons, against 23,251,539 tons in 1900. The Canadian canal shows: Registered tonnage in 1902, 4,547,561; in 1901, 2,404,642 tons, against 2,160,490 in 1900. A marked contrast between the business of the St. Marys Falls and Welland Canals is found in a comparison of their figures for a term of years. The number of vessels passing through the Welland Canal in 1873 was 6,425, and in 1899, 2,202, a reduction of more than one-half in the number of vessels. The number of vessels passing through the St. Marys Falls Canal in 1873 was 2,517, and in 1902, through the American and Canadian canals, 22,659. —*Bureau of Statistics, Department of Commerce and Labor.*

Dalny, The Township.—The township of Dalny comprises an area of 75 square versts (21,000 acres), and during the current year it is proposed to purchase an additional tract of 25 square versts (7,000 acres) on the northwest of the township.

The lands forming the township of Dalny were purchased in 1899 by the Chinese Eastern Railway Company from the local inhabitants at a price fixed by a committee of appraisers. On these grounds were formerly several small Chinese villages, the inhabitants of which were principally devoted to agriculture and fishing.

The city of Dalny is picturesquely situated in an extensive valley which slopes gently down to the deep and well-protected bay of Talienwan, and is surrounded on three sides by a range of hills rising to a height of 800 feet. It is divided into three parts—The Administration City, the European and Commercial City, and the Chinese City.

Administration City.—The Administration City borders on the harbor

and bay and is 108 acres in extent. All space in the administration quarter is reserved for the use of the Chinese Eastern Railway Company and its officials. In this section are the residences and offices of the governor and other officials of the railway company. There are over 200 buildings erected, besides a large area of temporary structures for minor employes and workmen.

Among the principal buildings are one hundred and twelve handsome brick and stone residences, the Administration Building, the port office, the seagoing-service office, the Greek church and school buildings, the railway company's hospital (for one hundred and eighty-six patients), the post, telegraph, and telephone offices, the Service Club and Concert Hall, the Yacht Club, Hotel Dalny, the Russo-Chinese Bank, police office and jail, the electric plant, machine shops, and the principal stores and shops.

The city is supplied with water and electric lights throughout, and has an adequate police force and fire brigade, which extends also to the Commercial City.

The permanent buildings of Dalny are at present confined almost entirely to the Administration quarter.

European and Commercial City.—The European and Commercial City, which has an area of 1,100 acres, borders on the harbor and extends to the range of hills on the south and east.

Along many of the principal avenues and streets of the Commercial City a large number of shops, stores, hotels, and dwelling-houses have been built for the accommodation of both the large native population and foreigners. Most of these buildings, however, are only temporary. They are put up on the company's land with permission of the city authorities, and are to be removed in case the lots upon which they are built are sold or leased.

The most central part of the Commercial City is Nicholas place, from which ten avenues branch. Around this circle (which is 700 feet in diameter) it is intended that the public buildings, banks, hotels, and office buildings shall be erected. Nicholas place is connected with the piers and shipping quarter by Moscow avenue, which is to be the main business thoroughfare of the city.

The residential section is to be on the elevated ground of the European City.

Chinese City.—The Chinese quarter is separated from the Administration and European cities by the town park and nurseries, which are upon the site of an old Chinese village.

XUM

Climate of Dalny.—The climate of Dalny is agreeable, healthful, and dry. According to the weather bureau of Dalny, the temperature in winter for the last four years has not been below 19° C. (3° F. below zero). During very severe winters the bay becomes frozen, but ice breakers are to keep the channel and harbor open for navigation.

Building the City.—In the construction of the city thousands of Chinese laborers are daily engaged in the enormous excavations, the making of streets and roads, and the completion of the work on the harbor. Numerous steam and tram lines are used for the conveying of earth and stone and for filling in the piers and water front.

The harbor is the scene of the greatest activity at present. The small harbor has been dredged to a depth of 18 feet, and the pier for coast steamers (which has been in use for over a year) is nearly completed and has a railroad to its end.

The work on the large dry dock is progressing rapidly; the cofferdam is built and the excavation well under way. This dry dock is to be 630 feet long, 88 feet wide, and 28 feet in depth, and will cost about 1,800,000 rubles ($927,000).

The eastern side of the large pier for ocean steamers is completed and in use nearly to its end; on the west side the walls are nearing completion, and one of the iron wharves for light-draft vessels is built. Three railway tracks connecting with the main line and two storage warehouses, with a floor area of 19,600 square feet each, are completed. This pier is 1,925 feet long and 350 feet wide, and has a depth of water of from 18 to 28 feet, and when completed will contain seven railway tracks and nine large warehouses.

One can judge from this splendid pier how thoroughly and substantially the construction of the harbor is being done. The foundation is laid with 50-ton concrete blocks and the walls finished with the best of dressed granite.

For the outside pier, the foundation only is laid. The wharf between the two piers is completed and in use. The foundation of the breakwater is finished for a distance of 2,800 feet and the sea wall along St. Petersburg quay is built.

Work Accomplished.—

Area of port territory filled in, square yards	6,800,000
Dredged from harbor, cubic yards	3,166,000
Earth excavated, cubic yards	12,916,000
Stone brought by rail, cubic yards	375,412
Stone brought by sea, cubic yards	882,210

Length of streets made, yards	77,000
Streets macadamized, yards	20,300
Sidewalks made, miles	6
Suburban roads made, miles	14

Railway Service.—The branch railway connecting Dalny with the main line of the Chinese Eastern Railway at Nangalin was built and formally operated by the engineers in charge of the construction of Dalny. At the beginning of the current year this branch road was given over to the control of the main line, and Dalny was connected by daily service of through trains with Port Arthur, Harbin, and Manchuria. Prior to this, the Manchurian trains did not come to Dalny, passengers and freight being transferred at Nangalin. Besides the Manchurian service, there are now two daily trains between Dalny and Port Arthur and two weekly express trains between Dalny, Moscow, and St. Petersburg.

On February 21, 1903, the first passenger express train from St. Petersburg and Moscow arrived at Dalny, and the weekly Trans-Siberian express service was inaugurated. The demand for passages on this quick and comfortable route became so great that another train was soon added.

The Trans-Siberian express leaves Dalny on Tuesdays and Saturdays, making a trip to Moscow—a distance of 5,375 miles—with a change of cars at Manchuria Station and Baikal, in thirteen and one-half days. The "train de luxe" is a solid vestibuled train, composed of coaches of the International Sleeping Car and Express Train Company, having first and second class compartments and sleeping car and dining car.—*Consular Reports*, September, 1903.

The Bagdad Railway and German Commerce in Asia Minor.—There exists to-day a railroad from Constantinople to Konieh, in Asia Minor, which is called the Anatolian Railway. It has branches to Smyrna and Angora. German financiers have succeeded in getting a concession from Turkey to continue this route from Konieh to Bagdad, and eventually through to Koeit, on the Persian Gulf. A corporation for the purpose of building the road has been formed in Constantinople, under the name of the Imperial Ottoman Bagdad Railway Company, with a capital of $3,000,000. Its president is one of the managers of the German Bank in Berlin. The Anatolian line to Konieh will not be merged into the larger concern, but its coöperation with the new

enterprise has been assured. The approximate cost of the railroad is $90,000,000, and it will be about 1,800 miles in length.

It is claimed that when the enterprise is completed it will bring India three days nearer London. It will shorten, by fourteen days, the journey by camel train from Aleppo to the valley of the Lower Euphrates, where almost every square mile of land has its interesting ruin or hidden treasure. Speaking of the country between the Euphrates and Tigris, the Chemnitzer Tageblatt says: The railway will pass through one of the oldest and richest countries in the world. The most fruitful part of what was once ancient Mesopotamia is that part of the country between Urfa and Mosul. So regular and plentiful are the rains that out of every six or seven harvests only two fall short. In other portions of the country rain is not so frequent, and the soil must be nurtured by irrigation. The land is adapted to raising wheat, barley, rice and cotton. A territory as large as Saxony and Italy together will be opened up to German markets.

To find the shortest way to India is an achievement which has occupied the attention of European commercial nations since the earliest times. The highway built by the Persian satraps, the success of Vasco da Gama in finding a water way around Africa, and the construction of the Suez Canal mark epochs in the development of European commerce with India. The construction of the Bagdad Railway will probably be fraught with equally great results, as it will not only serve as a connecting link between the Black Sea and the Persian Gulf, but it will tap a large territory which in recent times has been of practically no value to the commercial world at large.—*Consular Reports*, August, 1903.

A Plan Which Interested a Geography Class.—While teaching in a graded country school, I found the pupils looked upon geography as a most uninteresting subject of study. I had, from a child, been fond of the study of this subject and determined that if it were possible I would awaken in these children a love for geography.

I found little trouble in interesting the first, second, and third grade children, but found it more difficult with the fourth grade. The pupils had been using the text-book alone for their material of study. I examined the text and found it was not a poor one, but that the children had grown tired of using it as a reader and reciting from it in the same manner every day. I decided upon another plan of study.

In the neighborhood of the school was a natural clay bed. The children of this class and I went there one afternoon and modeled a

number of objects until each child was interested and knew it would not be impossible for him to model a large ball or globe. We chose the best of the clay, and cleaned it from any sticks or lumps. Each child carried home with him enough clay to form a globe nine inches in diameter. The children were instructed how to make their globes solid, how to place them to dry, and how, finally, with their mother's permission, to bake them in their mother's ovens.

While the globes were drying, the children prepared papier mache. This was done by tearing paper into very small pieces and cooking. After the paper had been cooked and had cooled, most of the water was poured off and the paper kneaded with the hands until it became a smooth pulp. Each child prepared his own papier mache and brought it to school in a clean cloth.

Some time was then spent in studying the relief maps of the different continents and modeling them from their papier mache. None were allowed to dry, but the pulp was returned damp to the cloth.

When the globes had been dried and baked and were brought to school, the large globe on the teacher's desk was studied and carefully compared with the ones they had made. The globe was studied in order to learn the relative positions of the continents, the relative amounts of land and water, and, finally, in a very general manner, allowing the pupils to speak of anything about the globe that appealed to them.

Many of the globes were good in shape, solid, and free from cracks. They were heavy and not easy to handle, but the pupils were delighted with them, and protested they were not "too heavy." After the material had been prepared, the study of the book and globe made, we were ready for the final work. The children placed their globes on their desks and drew the zone lines and a few meridians. They then, after careful measurement, drew an outline of each continent in its proper place. They then put the papier mache on, and modeled the continents in relief. This was allowed to dry, and when the globe was completed, each pupil had a relief map of the world. Of course the bare clay represented the water and the papier mache the land. The water was not the regulation "blue," and as we had no water colors we managed to be content with a dull brown.

Now, of course, this work was not done in a day, week, nor month, nor was it allowed to drag along until pupils grew despondent of seeing the end of their labors, but it did take time and thought on the part of both teacher and pupil. But the device proved a success in interesting the pupils in the study of geography.—*The Intelligence.*

Addition to the List of Geographical Societies of America.—The list of Geographical Societies published in the September, 1903, number of the JOURNAL OF GEOGRAPHY failed to include mention of the Geographical Society of the Pacific, one of the oldest societies. Through the courtesy of Professor Davidson of the University of California, I am able to add a notice.

THE GEOGRAPHICAL SOCIETY OF THE PACIFIC

The Geographical Society of the Pacific was organized March 16, 1881, by citizens interested in the geography and exploration of the western coast of America, and of the islands and lands adjacent to the Pacific. The purpose of the society is to gather geographical information for publication, to conduct lectures by travelers and explorers, to publish material of interest to geographers, and to form a library of geographical works, maps, and charts. The society was incorporated January 5, 1892. It has a well-chosen library of books and charts, and exchanges publications with 135 home and foreign geographical societies. Meetings are held monthly and bulletins are published. The membership of the societies consists of fellows, associates, honorary and corresponding members. Honorary members are chosen on account of their distinction in the science of geography, and not more than two of them are elected in one year. Corresponding members are chosen from those who have added to the advancement of geography, and not more than three of them are elected in one year. Associates, corresponding, and honorary members have no voice in the management of the society. There is provision made for junior members. Boys and girls under age are admitted as junior members at one-half rates. The annual dues are $6.00. Any fellow of the society may be given a life fellowship on the payment of $100. Persons who have rendered valuable service to the society for ten years may be given life fellowship without fees. Any fellow who shall have paid his dues continuously for twenty years may become a life member without further payment of dues. The society has rooms at 419 California Street, San Francisco. The president is Professor George Davidson, of the University of California.—*J. Paul Goode.*

Current Articles on Commerce and Industry:

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Argentina, Opportunities in, *Bradstreet's*, September 26.
Boston: City Characters (Illus.), *World To-Day.*
Canal; Proposed Forth-Clyde Ship Canal, *Cons. Report.*
China, The Building of Dalny (Illus.), *World To-Day.*

Copper Converting (Illus.), *Sci. Am.*, September 26.

Cotton Crop of To-Day (Illus.), *Rev. of Revs.*

Cotton Problem in the South (Illus.), *World To-Day.*

Cuba, Commercial, in 1903, *Mo. Summary of Commerce and Finance*, August.

Forest Planting in the U. S., *Miss. Valley Lumberman*, September 11 and 18.

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Gun Making (Illus.), *World's Work.*

Italy: Thirty Years of Progress, *World's Work.*

Macaroni Wheat Question, *Bradstreet's*, September 19.

Mexico, The American Influence in (Illus.), *World's Work.*

Mexico, Pulque and Mescal of (Illus.), *Sci. Am.*, September 19.

Potters and Their Products (Illus.), *Clay Worker*, September.

Railroad Accidents in America and Europe, *World's Work.*

Railroad Engineering, Modern Feats of (Illus.), *World's Work.*

Rice, Cultivation of in the United States, *Jour. of Geography.*

Rice Culture in the Philippines, *Mo. Summary of Commerce of the Philippines*, May.

Silk, Artificial, *Sci. Am. Supp.*, September 19.

Storms, Frosts, and Their Effect on Business, *Paint, Oil, and Drug Rev.*, September 16.

Sugar Discovery in the Beet, *Bradstreet's*, September 12.

Tea-Raising Methods, *Comm. Bull. and N. W. Trade*, September 19.

Timber Standing in the Country, *Miss. Valley Lumberman*, September 18.

Time (Illus.), *Jour. of Geography.*

OCTOBER

Alaska as an Investment, *Sci. Am. Supp.*, October 24.

Alaska, the Rich Empire of the North (Illus.), *World's Work.*

Americanizing Scotland's Industries, *Cons. Report.*

Canada: Turning Back to the Dominion, *Success.*

Chicago at the End of a Century (Illus.), *World To-Day.*

Cleveland (Illus.), *World's Work.*

Coal-Mining in the United Kingdom (Illus.), *Engineering Mag.*

Colombia and the Panama Canal (Illus.), *Engineering Mag.*

Diamond Mining in the Kimberley Field (Illus.), *Engineering Mag.*

Fisheries Commission, Work of (Illus.), *Sci. Am.*, October 24.

Garbage Disposal at Baltimore (Illus.), *Sci. Am.*, October 31.

Geography and History, *Jour. of Geography.*

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Holland: Reclaiming an Ocean Bed (Illus.), *McClure's.*
Immigrants: Where They Settle (Illus.), *World's Work.*
Industrial Schools in Germany, *Sci. Am. Supp.*; October 17.
Inventions, Epidemics in, *Trade-Mark Record.*
Iron and Steel Production of the World, *Cons. Report.*
Irrigation Question, A Phase of, *Bradstreet's*, October 3.
Japan, Foreign Commerce of, *Cons. Report.*
Java Petroleum Districts (Illus.), *Sci. Am.*, October 10.
Lumber Transportation (Illus.), *Sci. Am.*, October 17.
Metal-Working, The Modern Craft of (Illus.), *Sci. Am. Supp.*, October 3.
Municipal Reform and Social Welfare in New York (Illus.), *Rev. of Revs.*
Newspaper: Development of the Daily (Illus.), *Mahin's Mag.*
North Sea Fisheries, *Sci. Am. Supp.*, October 3.
Philadelphia (Illus.), *World To-Day.*
Salt Mining and Manufacture (Illus.), *Sci. Am. Supp.*, October 3.
South, a Seaboard Gateway of the West (Illus.), *World's Work.*
Sugar Supply of the United States, *Sci. Am. Supp.*, October 17.

NOVEMBER

Beet Sugar Making, *Comm. Bull. and N. W. Trade*, November 28.
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Camphor Industry of Formosa, *Sci. Am.*, November 21.
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Chicago: How a Great City Is Fed (Illus.), *World To-Day.*
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Corn-Growers (Illus.), *World's Work.*
Cost of Living, *Bull. of Bureau of Labor*, November.
Country Merchant Come to Town, *World's Work.*
Cuba, *Cons. Repori.*
Dairy Farming (Illus.), *Country Life in Am.*
Denver: Character Sketches of Cities (Illus.), *World To-Day.*
Galveston's Great Sea Wall (Illus.), *Rev. of Revs.*
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Labor Boss: The Trust's New Tool, *McClure's.*
Linseed Oil, Making of, *Paint, Oil, and Drug Rev.*, November 25.
Louisiana Purchase, *Bradstreet's*, November 7.
Moseley's Industrial Inquiry, *Cons. Repori.*
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Onion-Seed Farm in California (Illus.), *Sci. Am.*, November 7.

Panama, Commerce of, *Hide and Leather*, November 21.

Post Office and the People (Illus.), *World's Work*.

Printing Methods, Modern (Illus.), *Sci. Am.* (Special Number). November 14.

Rubber Tree of Central America (Illus.), *Sci. Am. Supp.*, November 28.

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Savings Banks, The Romance of, *Success*.

Scientific Research and Chemical Industry, *Sci. Am. Supp.*, November 14 and 21.

Tea-Growing in India, *Sci. Am. Supp.*, November 14.

Textile Industry of Philadelphia, *The Manufacturer*, November 16.

GEOGRAPHICAL QUERIES

A CLEARING HOUSE FOR GEOGRAPHICAL WANTS AND DOUBTS

IT is hoped this department will prove of practical benefit to teachers of geography, opening a way for the solving of the many geographical problems which are constantly met with in the classroom. All questions received will be answered by specialists in the various methods of geographical work. We invite inquiries, criticisms, suggestions, and discussions. Address all communications for this department to:

EDWARD M. LEHNERTS, *Winona, Minn.*

(5) As I am an old reader of the JOURNAL OF GEOGRAPHY and of its two parent magazines, I trust you will pardon me for troubling you with a question. To what extent and in what ways do forests influence climate? In your JOURNAL for April, 1902, in the excellent article entitled "Certain Persistent Errors in Geography," Mr. Henry Gannett positively affirms that forests have absolutely no influence on rainfall. I cannot see the reason for his statement; and hence my question, which I hope you will find worthy of a reply.

A. H. G., South Bend, Ind.

Every one of our readers, old and new, is cordially invited—yes, even urged—to send us any geographical question that is giving trouble. Your letter is therefore more than welcome, and we gladly reply as fully as our space permits.

In the article you refer to, Mr. Gannett exposes and condemns in a vigorous and effective manner certain widespread geographical misconceptions including the popular belief that the removal of forests greatly decreases the rainfall. He does not, however, raise the question whether forests have any appreciable influence on climate. This

question has been discussed for years, and much time has been given to its study; but most of the conclusions reached would seem apparent even without any elaborate investigation.

It is a matter of common observation, particularly on sunny summer days, that the ground and the air under the trees are cooler than the soil and the air in the open field; and this effect is not only noticeable by day, but by night as well, as every one will testify who is acquainted with the cool, damp evenings and nights of our wooded areas. This lowering of the temperature is caused by the shading of the ground and by the increased evaporation and radiation from the leaves, which present an enlarged surface for these processes, transpire large amounts of water, and possess a radiating power equal to that of soot. Of course, the effect is increased with the size and the number of the trees, the density of the foliage, and the extent of the forest. Moreover, the kind of trees, whether deciduous or evergreen, makes a considerable difference, especially in our northern latitudes in the spring season. In the deciduous woods on the shaded northward slopes of the bluffs about Winona, the snow in spring lasts from one to three weeks longer than in the open fields; but in the evergreen forests of northern Minnesota, especially on northward slopes, snow and ice remain until the beginning of summer. The Indians even claim that they can find ice in the dense cedar swamps of that section at any time during the summer and fall. In general, forests retard the melting of the snow in spring and thus lower the temperature, favor frosts, and delay the approach of warmer weather.

The following tables taken from Hann's Handbook of Climatology give interesting data regarding the influence of forests on temperature:

MEAN TEMPERATURE OF VIENNA CITY, COUNTRY, AND FOREST, 1851–1880. ALTITUDE ABOVE SEA LEVEL THE SAME IN ALL CASES. CENTIGRADE SCALE.

	January	April	July	October	Year
Vienna City	−1.2°	10.0°	20.4°	10.5°	9.7°
Vienna Country	−1.5°	9.6°	19.8°	10.1°	9.2°
Vienna Forest	−1.5°	9.0°	19.2°	9.6°	8.8°

VIENNA FOREST COMPARED WITH VIENNA COUNTRY, 1875–1884. THE FIGURES SHOW HOW MUCH COLDER IT WAS IN THE FOREST. CENTIGRADE SCALE.

	7 a. m.	2 p. m.	9 p. m.	Mean
In Winter	0.8°	0.0°	0.8°	0.6°
In Summer	1.1°	0.2°	2.3°	1.4°

On our western prairies nearly every farmhouse has its grove of trees to serve as a protection against cold winds and drifting snows. This illustrates another important effect of forests, namely, the breaking of the force of winds and the checking of air currents. Partly because of this diminished air movement and partly because of the coolness due to the stoppage of the sunshine by the leaves, the forest keeps the air under its cover relatively moist; and since cool, moist, and quiet air does not favor evaporation, and since this process is still further retarded by the protective and water-holding capacity of the forest floor, it is not surprising to learn that observers find the annual evaporation within the forest to be about one-half of that in the open field. This leads to the conservation of the water supply, one of the most important of forest influences. Rain water is retained; evaporation is decreased; surface flow-off and underground circulation are regulated; stream flow is controlled; excessive erosion and floods are prevented; and many other beneficial effects are produced.

Wherever a forest has been considerably reduced in area, changes in the water supply have occurred; in certain cases, wells, springs, and small streams have become intermittent and even permanently dry. Extensive reforestation, on the other hand, has been known to again bring water to the well and to re-establish the spring and the stream flow. Some observers, believing these effects to be due to changes in the amount of rainfall, concluded that extensive deforestation always caused a corresponding decrease in the annual precipitation. It is, however, perfectly clear that such a conclusion is not safe since the forest influences mentioned in the preceding paragraph are in themselves adequate causes.

The question whether forests increase the annual rainfall has been answered in the affirmative by many careful observers and students, including Blanford,[1] Müttrich,[2] Hettner,[3] Hann,[4] and many others; but their answer is based on data and methods of investigation which cannot be adequately set forth here because of lack of space.

The earliest and most untrustworthy data are those obtained by the historical method. Ancient history and literature give illustrations

[1] H. F. Blanford: "The Influence of the Indian Forests on the Rainfall," *Journ. Asiat. Soc. Bengal*, LVI, Part II, 1887, pages 1–15.

[2] A. Müttrich: "Ueber den Einfluss des Waldes auf die Grösse der atmosphärischen Niederschläge," *Das Wetter*, IX, 1892, pages 46–48, 68–71, 90–96.

[3] A. Hettner: *Regenvertheilung, Pflanzendecke, und Besiedelung der tropischen Anden*, 1893, Berlin.

[4] J. Hann: *Handbuch der Klimatologie*, English Translation by R. DeC. Ward, 1903, The Macmillan Co., New York.

of forested and well-watered regions which have since become deforested and arid; but such data are imperfect and unreliable, and, even in cases where former humidity and present aridity are authenticated facts, the change can be shown to be due not to a decrease in the rainfall but to changes in distribution and circulation of the rain after it has fallen, or to dry winds no longer checked and modified by the former forest barrier.

A second and more satisfactory source of data is furnished by meteorological records; and these point to three definite conclusions: That about 9 per cent more rain falls over a forest than over open fields in the immediate vicinity; that the precipitation is somewhat greater in the tree-covered areas as compared with the treeless districts of a given region, and that in cases of reforestation the precipitation has increased with the increasing forest growth. Recent writers, however, especially in America, have shown a disposition to question these conclusions; and some have gone so far as to deny that forests have any appreciable influence on rainfall. Professor Cleveland Abbe[5] of the United States Weather Bureau has clearly shown that the great mass of meteorological data is not reliable, so far as this problem is concerned, since rain gauges in open places catch less rain than they should, owing to the influence of the stronger wind. Wherever the gauges have been properly corrected in accordance with Professor Abbe's suggestion, there has been found no appreciable difference in the amount of rainfall over the forest and over the open land; and it is now generally conceded that the facts at hand do not prove conclusively that forests increase rainfall.

As regards climate, then, forests tend (1) to lower the mean temperature of the air; (2) to check air movement; (3) to increase its relative humidity; (4) to equalize day and night temperatures and to make seasonal extremes less severe; (5) to favor frosts and fogs, and, some say, clouds and rain; and (6) to increase the healthfulness of the locality by decreasing the number of disease-producing organisms in the air, the water, and the soil. In short, the influence of the forest on the local climate is considerable, but its effect on the general or regional climate is not appreciable. E. M. L.

[5] C. Abbe: "Determination of the True Amount of Precipitation and Its Bearing on Theories of Forest Influences," Bulletin No. 7, 1892, Forestry Division, U. S. Dept. of Agriculture, pages 175–185.

EDITORIAL

SIGNS OF THE TIMES

THE beginning of a new year is a favorable time to summarize the results, the successes of the past, and estimate the direction thought and action will probably take in the future in our chosen field of work.

At no period during the last decade has there been a time when the signs of the times were more encouraging than they are now. Geography teaching is slowly but surely improving. The subject is receiving increasing emphasis in normal schools, in secondary schools, and at teachers' institutes, and teachers are seeking enlightenment and help in the subject constantly. In spite of all setbacks and the persistence of ultra conservatism in some cities and states, in spite of the unnaturalness of geography as still taught in the larger number of rural schools, there is good reason to be optimistic and not pessimistic as to the future of the subject.

Among the evidences of progress in elementary school geography since the "renaissance," which dates from the appearance of Frye's first book in 1894, may be noted more logical, more usable text-books, and a greater emphasis of the causal idea and the phenomena of the home environment. Writers of texts for elementary schools now adopt a plan of procedure whereby the subject is modified to fit the pupil, instead of the pupil being wholly molded to fit the text. The better text-books now contain fewer unessential points, fewer imaginary, untruthful illustrations, better maps (though in this regard there is still great room for improvement), references to collateral reading for teachers and pupils, and are in general more geographical than their predecessors.

In the secondary field there are several excellent texts, and laboratory and field work have come to stay. The fact that geography has been accepted as an entrance requirement by several colleges has stirred many secondary schools to better work in the subject. Broadly considered, perhaps the most satisfactory progress in geography within the decade has been in this field.

In normal and training schools, on the other hand, the subject is in a very unsatisfactory position. There are many normal schools in which geographers have been employed as leaders in the work, and it

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is needless to say that this group of schools has led the way in reform in the training of teachers of geography. In a large number of the normal schools, however, geography is still stagnant, and in this field there is the greatest need for improvement.

The progress in the higher institutions has not been as great in proportion as in the lower institutions. In many colleges and universities geography does now have a place, but in many others it is unknown or given a mere foothold. Even where geography is taught it is not commonly related to the work of other departments, such as history and sociology, as it should be, and hence the success is not as great as it might readily be. The teachers for the secondary and normal schools must come from the colleges and universities largely, and the demand for such trained teachers is far in excess of the supply.

One of the most favorable evidences of progress is the fact that the public and educational officers are alive to the worth of geography as a subject of culture and training. This is well illustrated by the increasing number of teachers of all grades of work who seek opportunities to secure better training in geography through teachers' classes or summer schools. The success of the Cornell Summer School of Geography in 1903 is the best test of the increasing demand by teachers for better training in geog aphy we have had, and it is most encouraging.

Progress has been made, and is going to be made rapidly in the next few years. Faddism in methods of teaching is passing away; rural school geography is being strengthened through the introduction of agriculture and geographical nature study; better courses of study are being adopted in elementary schools; laboratory work is being introduced into secondary and normal schools; and the text-book is not always followed slavishly now. In our zeal for better things, however, we are in danger of forgetting that pupils must be taught to study and think, to apply their knowledge in daily life, and that the easiest way to the goal is not always the best. If, ten years hence, those who have been pupils in this decade do not know the facts and principles of geography necessary for an understanding of current affairs, it will be a good indication that the pendulum has swung too far and that in our endeavor to make things interesting we have failed to give the best discipline and training.

REVIEWS

Field and Laboratory Exercises in Physical Geography. By James F. Chamberlain. Size 10 x 8. Pp. 127. New York: American Book Company, 1903.

While the teaching of Physical Geography through the laboratory is no longer in the experimental stage, the use of this method is necessarily restricted to those few whose training has been of a nature to enable them to organize this line of work for themselves.

For the great majority, the need of a laboratory manual is an imperative one and each new contribution to the field is eagerly welcomed, not only by the teacher of many subjects, whose training is inadequate to meet the situation unaided, but also by the specialist who is desirous of seeing Physical Geography taught according to the best method.

The book noted above seems well adapted to meet the needs of the situation. The exercises, sixty-nine in number, touch upon the various departments of the subject: "The Earth as a Globe," "The Atmosphere," "The Ocean," "The Lands," and "Life," and are fairly well proportioned. More space, however, should have been devoted to the lands through the study of topographic sheets illustrating typical land forms.

The exercises generally are elementary in character, easily within the comprehension of pupils of the upper grammar grades or of the first year of a high-school course.

The sequence of the topics treated usually is logical though in some cases a rearrangement should be made, as, for instance, in the case of exercises thirty-one and thirty-three where the study of "isobars" follows that of "cyclonic areas."

Many of the problems presented do not fall properly either in field or in laboratory work, for their solution lies in the library alone. While this work is valuable, it should not be confounded with laboratory work.

The manual serves a double purpose, outline maps and blank pages for recording observations accompanying the problems.

The book will, without doubt, be found helpful in offering suggestions, and should be used from this standpoint rather than as an infallible guide.

C. B. K.

RECENT PUBLICATIONS

Special Method in Geography. From the Third through the Eighth grade. By Charles A. McMurry. New edition. Pp. xi and 217. New York: The Macmillan Company, 1903.

A new and much-enlarged edition of Dr. C. A. McMurry's well-known book on geography teaching. Very detailed in its suggestions, and especially adapted to the Tarr & McMurry geographies. Would have been more readily usable if accompanied by an index. To be reviewed later.

Waterways of Westward Expansion, *being Volume IX of Historic Highways of America.* By Archer Butler Hulbert. Pp. 220. Cleveland, Ohio: The Arthur H. Clark Company, 1903.

This book deals particularly with the Ohio River and its tributaries, and is fuller and more complete than most of its predecessors in the series. Contains three

reproductions of old maps. Valuable especially to the student of American history as related to its geography.

Indians of the Painted Desert Region. By George Wharton James. Pp. xxi and 267. Boston: Little, Brown & Company, 1903.

An attractive and readable book on the Indians of Arizona and New Mexico, by a well-known writer on Indians. Well illustrated. To be reviewed later.

Descriptive Geography from Original Sources: Australia and Oceanica. By F. D. and A. J. Herbertson. Pp. xxvi and 221. London: Adam and Charles Black, 1903.

The last of the several volumes devoted to the different continents and prepared by Dr. and Mrs. A. J. Herbertson. Like the preceding volumes, this volume contains an excellent introductory chapter, bibliography, and index. The material is well selected, well illustrated, and very usable. The volume is excellent for supplementary use in the higher grammar grades of American schools.

Around the Caribbean and Across Panama. By Francis C. Nicholas. Boston and New York: H. M. Caldwell Company, 1903.

An interesting account of an explorer's adventures in the region indicated by the title. Written by an authority and well illustrated.

Elementary Geography. By Charles F. King. Pp. vi and 220. Boston: Lothrop Publishing Company, 1903.

An elementary geography by an experienced and well-known teacher. Descriptions of excursions and imaginary journeys are made the means of imparting both general and regional facts. Excellent illustrations, some being colored. Illustrations of animals especially fine. Maps are somewhat crude and proper names are not always spelled correctly. To be reviewed later.

NEWS NOTES

The New Republic of Panama.—Early in November the State of Panama, hitherto a part of Colombia, seceded and established a new republic known as Panama, and on November 6th this republic was recognized as a new nation by the Government of the United States. The action taken by the inhabitants of Panama was primarily due to the fact that Colombia had stood in the way of allowing the United States to build the Panama Canal. The inhabitants of Panama, having been paying large amounts in taxes to Colombia, felt that they had not been duly considered by Colombia and that their business interests had been sacrificed; hence their action.

Meeting of National Educational Association in 1904.—It has been decided to hold the 1904 meeting of the National Educational Association at St. Louis during the latter part of June or the early part of July. The various features of the exposition will be made the chief topics of the papers and discussions, and thus the meeting will be centered about the exposition. Details as to time of meeting and the attention to be given to geography will be announced in the JOURNAL as the plans mature.